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☐ 1. Document ID: US 6633835 B1

L4: Entry 1 of 8 File: USPT Oct 14, 2003

US-PAT-NO: 6633835
DOCUMENT-IDENTIFIER: US 6633835 B1

TITLE: Prioritized data capture, classification and filtering in a network monitoring environment

DATE-ISSUED: October 14, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Moran; Mike	Sandwich	IL		
Liubinskas; Tauras	Aurora	IL		
Goral; Jack	Woodridge	IL		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Networks Associates Technology, Inc.	Santa Clara	CA			02

APPL-NO: 10/ 046027 [PALM]
DATE FILED: January 11, 2002

PARENT-CASE:
RELATED APPLICATION This application is a continuation of a parent application entitled "MUTI-SEGMENT NETWORK APPLICATION MONITORING AND CORRELATION ARCHITECTURE" and naming Mike Moran, Tauras Liubinskas, and Jack Goral as inventors, and which was filed Jan. 10, 2002 under Ser. No. 10/043,501, and which is incorporated herein by reference in its entirety.

INT-CL: [07] G06 F 12/00

US-CL-ISSUED: 702/190; 702/181, 702/182, 702/183, 702/188, 702/189
US-CL-CURRENT: 702/190; 702/181, 702/182, 702/183, 702/188, 702/189

FIELD-OF-SEARCH: 702/179, 702/180, 702/181, 702/182, 702/183, 702/188, 702/189, 702/190, 709/108, 709/226, 395/183

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5506955	April 1996	Chen et al.	395/183.02
6460010	October 2002	Hanes et al.	702/179
2002/0059424	May 2002	Ferguson et al.	709/226
2002/0080180	June 2002	Mander et al.	345/769

ART-UNIT: 2857

PRIMARY-EXAMINER: Hoff; Marc S.

ASSISTANT-EXAMINER: Suarez; Felix

ATTY-AGENT-FIRM: Silicon Valley IP Group Zilka; Kevin J. Hamaty; Christopher J.

ABSTRACT:

A system, method and computer program product are provided for adaptive priority data filtering. Data is collected from a network segment and classified into multiple flows. The flows are prioritized into high and low priority flows. High priority flows are stored in a high priority queue prior to processing, while low priority flows are stored in a low priority queue prior to processing. An amount of data in the high priority flows is monitored. Buffers from the low priority queue are reallocated to the high priority queue if the amount of data in the high priority flows surpasses a predetermined threshold.

18 Claims, 44 Drawing figures

☐ 2. Document ID: US 6571285 B1

L4: Entry 2 of 8 File: USPT May 27, 2003

US-PAT-NO: 6571285
DOCUMENT-IDENTIFIER: US 6571285 B1

TITLE: Providing an integrated service assurance environment for a network

DATE-ISSUED: May 27, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Groath; Steve G.	Burnsville	MN		
Miller; Myke L.	Excelsior	MN		
Sachse; Christopher	Maplewood	MN		
Bloom; Jeremy D.	San Francisco	CA		
Turkson; Leslie T.	Eagan	MN		
Lund; Timothy	Lakeville	MN		
Beskar; Patrick J.	Mahotmedi	MN		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Accenture LLP	Palo Alto	CA			02

APPL-NO: 09/ 470776 [PALM]
DATE FILED: December 23, 1999

INT-CL: [07] G06 F 15/173

US-CL-ISSUED: 709/223; 709/223, 709/224, 370/352, 370/389
US-CL-CURRENT: 709/223; 370/352, 370/389, 709/224

FIELD-OF-SEARCH: 709/500, 709/527, 709/680, 709/683, 709/614, 709/615, 709/224, 709/318, 709/223, 370/352, 370/389, 370/392, 370/383, 370/395, 370/390

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5650994	July 1997	Daley	370/259
5774689	June 1998	Curtis et al.	709/500
5867495	February 1999	Elliott et al.	370/352
6182157	January 2002	Schlener et al.	

ART-UNIT: 2155

PRIMARY-EXAMINER: Winder; Patrice

ASSISTANT-EXAMINER: Nguyen; Thu Ha

ATTY-AGENT-FIRM: Oppenheimer Wolff & Donnelly LLP

ABSTRACT:

A method providing service assurance for a network to maintain an agreed upon Quality of Service. First, an alarm is generated to indicate a status of a network. The generation of the alarm comprises selecting a parameter of network to be monitored; determining a triggering level of the parameter; monitoring the parameter of an occurrence of the triggering level; and initiating alarm notification upon the monitored occurrence of the triggering level. Network event information is then dispatched upon generation of the alarm and is subsequently mapped. The data collected on the status of the network is then manipulated by concatenating the data collected on a network into a master file; reformatting the data into a standarized format; translating the data to key codes; sorting the data according to predetermined criteria; and concatenating the sorted data together. The data is then sorted in a database. Thereafter, network availability is conveyed graphically.

12 Claims, 39 Drawing figures

☐ 3. Document ID: US 6408335 B1

L4: Entry 3 of 8 File: USPT Jun 18, 2002

US-PAT-NO: 6408335
DOCUMENT-IDENTIFIER: US 6408335 B1
**** See image for Certificate of Correction ****

TITLE: Methods, systems and computer program products for endpoint pair based communications network performance testing

DATE-ISSUED: June 18, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Schwaller; Peter James	Raleigh	NC		
Walker, II; John Quillian	Raleigh	NC		
Joyce; Steven Thomas	Raleigh	NC		
Huntley; Timothy Scott	Raleigh	NC		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
NetIQ Corporation	Santa Clara	CA			02

APPL-NO: 09/ 158461 [PALM]
DATE FILED: September 22, 1998

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATIONS This application is a continuation of application Ser. No.08/711,607, filed Sep. 10, 1996 now U.S. Pat. No. 5,838,919. This application is related to the following applications filed concurrently herewith: SYSTEMS, METHODS AND COMPUTER PROGRAM PRODUCTS FOR APPLICATIONS TRAFFIC BASED COMMUNICATIONS NETWORK PERFORMANCE TESTING, Ser. No. 08/711,248 and, METHODS, SYSTEMS AND COMPUTER PROGRAM PRODUCTS FOR TEST SCENARIO BASED COMMUNICATIONS NETWORK PERFORMANCE TESTING, Ser. No. 08/711,195.

INT-CL: [07] G06 F 15/173

US-CL-ISSUED: 709/224; 709/223, 703/13, 703/21
US-CL-CURRENT: 709/224; 703/13, 703/21, 709/223

FIELD-OF-SEARCH: 709/202, 709/223-224, 709/218, 709/238, 709/227, 709/1, 370/230, 370/229, 370/235, 370/241, 370/250, 370/901, 370/13, 703/26, 703/13, 703/21, 714/712

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4545011	October 1985	Lyon et al.	714/43
5049873	September 1991	Robins et al.	340/825.06
5107450	April 1992	Lawrenz	709/224

5257393	October 1993	Miller	709/224
5440719	August 1995	Hanes et al.	703/21
5572640	November 1996	Schetler	345/440
5634009	May 1997	Iddon et al.	709/223
5668800	September 1997	Stevenson	370/248
5706436	January 1998	Lewis et al.	709/235
5732213	March 1998	Gessel et al.	709/224
5757778	May 1998	Kim et al.	370/252
5764915	June 1998	Heimsoth et al.	709/227
5809286	September 1998	McLain, Jr. et al.	703/23
5940472	August 1999	Newman et al.	379/1
6041041	March 2000	Ramanathn et al.	370/241

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0528075	February 1993	EP	

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IPB: An Internet Protocol Benchmark using simulated traffic, Proceedings, Sixth International Symp, IEEE, ISBN: 0-8186-8566-2, Jul. 1998.*
Brochure, "The DA-30.RTM. family of internetwork analyzers," Wandal & Goltermann (1994).
Brochure, "DA-30C Benchmarking Capabilities," Wandel & Goltermann (1995).
Brochure, "Vital Signs VisionNet," BlueLine Software, Inc., including inserts "LAN Agent," "VTAM Agent," "NCPL Agent" (1995).
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Brochure, "Standards Based Distributed Diagnostics for Enterprise Networks," Frontier Software Development, Inc. (Sep. 1995).
Brochure, "Quality Works--The most complete client/server testing solution you can buy," Segue Software Products (1996).
Brochure, "LANQuest: Net/WRx," LANQuest (Sep. 12, 1995).
Brochure, NETBENCH(R) 3.01 Frequently Asked Questions, Ziff-Davis Benchmark Operations.

Butterfield, "System Performance Monitor/2 Reference," International Business Machines Corporation (1991).

ART-UNIT: 2152

PRIMARY-EXAMINER: Geckil; Mehmet B.

ASSISTANT-EXAMINER: Prieto; Beatriz

ATTY-AGENT-FIRM: Myers, Bigel, Sibley & Sajovec, P.A.

ABSTRACT:

Communications network performance is tested utilizing a test scenario simulating actual communications traffic on the network to be tested. The test scenario includes an endpoint node specific test protocol between an endpoint node pair including a first and associated second endpoint node on the network to be tested. A partner endpoint node test protocol is determined from the endpoint node specific test protocol and communicated to from the first endpoint node to the associated second endpoint node of the endpoint node pair. A plurality of endpoint node pairs may executed different endpoint node specific test protocols under a test scenario. A console node is provided on the network for establishing the test scenario and assigning the test scenario to endpoint node pairs and initiating execution of the test scenario. Performance data may be monitored at one of the endpoint nodes of each endpoint node pair and reported to the console node either as it is generated or after completion of the test. The test scenario may be terminated when any one endpoint node pair completes execution of its test protocol. Multiple network protocols may be utilized within a single test scenario. Each endpoint node specific test protocol includes an associated script representing a type of applications traffic such as a credit check, or a database. update. Endpoint node pairs execute tests as applications level programs on existing endpoint nodes allowing testing of networks using actual protocol stacks independent of the applications programs available on existing endpoint nodes.

21 Claims, 12 Drawing figures

☐ 4. Document ID: US 6397359 B1

L4: Entry 4 of 8 File: USPT May 28, 2002

US-PAT-NO: 6397359
DOCUMENT-IDENTIFIER: US 6397359 B1

TITLE: Methods, systems and computer program products for scheduled network performance testing

DATE-ISSUED: May 28, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Chandra; Vikas	Cary	NC		
McCorry; Mark Eric	Raleigh	NC		
Quan; David Vi Hien	Cary	NC		

Schwaller; Peter James	Raleigh	NC
Selvaggi; Christopher David	Cary	NC
Wood; John Lee	Raleigh	NC

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
NetIQ Corporation	Santa Clara	CA			02

APPL-NO: 09/ 234276 [PALM]
DATE FILED: January 19, 1999

INT-CL: [07] G06 F 11/00, G06 F 13/00

US-CL-ISSUED: 714/712; 709/224, 710/105
US-CL-CURRENT: 714/712; 709/224, 710/105

FIELD-OF-SEARCH: 714/712, 714/4, 714/38, 710/105, 703/13, 703/21, 702/108, 702/122, 702/182, 709/224, 709/200, 709/223, 709/238, 370/231, 370/251, 370/254

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4545011	October 1985	Lyon et al.	
5049873	September 1991	Robins et al.	
5107450	April 1992	Lawrenz	
5257393	October 1993	Miller	
5572640	November 1996	Schettler	
5634009	May 1997	Iddon et al.	
5706436	January 1998	Lewis et al.	
5732213	March 1998	Gessel et al.	
5764915	June 1998	Heimsoth et al.	
5809286	September 1998	McLain, Jr. et al.	
5838919	November 1998	Schwaller et al.	
5881237	March 1999	Schwaller et al.	
5937165	August 1999	Schwaller et al.	
6061725	May 2000	Schwaller et al.	

OTHER PUBLICATIONS

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Article, Sobel, Ken; "Compuware's EcoSCOPE";Hurwitz Group, Inc. (9/97).
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Brochure, "Vital Signs VisionNet", BlueLine Software, Inc., including inserts "LAN Agent", "VTAM Agent", "NCPL Agent" (1995).
Brochure, Vital Signs VisionNet (1995).
Brochure, "SmartBits: Switch testing in its simplest form . . . ", Netcom Systems, Inc. (1995).
Brochure, "EconNET.TM.: Networked Applications Performance Management", Compuware Corporation (1995).
Brochure, Hot off the Shelf: Application Management, Data Communications (Jan. 1996).
Brochure, "10 Reasons Why You Need an Applications View of Your Network," Compuware Corporation (Jan. 9, 1996).

ART-UNIT: 2181

PRIMARY-EXAMINER: Ray; Gopal C.

ATTY-AGENT-FIRM: Myers Bigel Sibley & Sajovec, P.A.

ABSTRACT:

Methods, systems and computer program products are provided which test network performance by defining test schedules including test protocols to be implemented and when the protocols should be executed for a plurality of defined connections on a network. A connection may be defined between two endpoint nodes on the network. At times specified in the test schedule, the endpoint node pair executes the test protocol and measures the performance of the network connection between the two nodes without requiring any involvement of application software which may or may not be installed on the computer hardware supporting the endpoint node. The test protocol may define the type of network layer protocol to utilize (for example, TCP), and the test script or scripts to be communicated using the appropriate stack on the computer hardware supporting the endpoint node. The schedule may be provided with an expiration date and a console node is provided for distribution of test schedules, monitoring of availability of endpoint nodes and receipt of measured performance measurements for reporting to a network manager. In further aspects of the present invention, auto-thresholding and coordination of interrelated but asynchronous tasks executing at the console node are provided.

34 Claims, 9 Drawing figures

☐ 5. Document ID: US 6061725 A

L4: Entry 5 of 8 File: USPT May 9, 2000

US-PAT-NO: 6061725
DOCUMENT-IDENTIFIER: US 6061725 A

TITLE: Endpoint node systems computer program products for application traffic based communications network performance testing

DATE-ISSUED: May 9, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Schwaller; Peter James	Raleigh	NC		
Walker, II; John Quillian	Raleigh	NC		
Joyce; Steven Thomas	Raleigh	NC		
Huntley; Timothy Scott	Raleigh	NC		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Ganymede Software Inc.	Morrisville	NC			02

APPL-NO: 09/ 229031 [PALM]
DATE FILED: January 12, 1999

PARENT-CASE:
This application is a continuation of application Ser. No. 08/711,248, filed Sep. 10, 1996, still pending. This application is related to copending application Ser. No. 09/158,461 entitled METHODS, SYSTEMS AND COMPUTER PROGRAM PRODUCTS FOR ENDPOINT PAIR BASED COMMUNICATIONS NETWORK PERFORMANCE TESTING, and still pending.

INT-CL: [07] G06 F 13/00

US-CL-ISSUED: 709/224; 370/230
US-CL-CURRENT: 709/224; 370/230

FIELD-OF-SEARCH: 709/224, 709/200, 709/201, 709/220, 709/221, 709/228, 370/230, 370/231, 370/251, 370/351, 370/397

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4545011	October 1985	Lyon et al.	714/43
5049873	September 1991	Robins et al.	379/14
5107450	April 1992	Lawrenz	709/224
5257393	October 1993	Miller	709/224

5572640	November 1996	Schettler	345/440
5634009	May 1997	Iddon et al.	709/223
5706436	January 1998	Lewis et al.	709/235
5732213	March 1998	Gessel et al.	709/224
5764915	June 1998	Heimsoth et al.	709/227
5809286	September 1998	McLain, Jr. et al.	395/500.44

OTHER PUBLICATIONS

Butterfield, "System Performance Monitor/2 Reference," International Business Machines Corporation (1991).
Brochure, "The DA-30.RTM. family of internetwork analyzers", Wandel & Goltermann (1994).
Brochure, "DA-30C benchmarking Capabilities", Wandel & Goltermann (1995).
Brochure, "Vital Signs VisionNet", BlueLine Software, Inc., including inserts "LAN Agent", "VTAM Agent", "NCPL Agent" (1995).
Brochure, Vital Signs VisionNet (1995).
Brochure, "SmartBits: Switch testing in its simplest form . . . ", Netcom Systems, Inc. (1995).
Brochure, "EconNET.TM.: Networked Applications Performance Management", Compuware Corporation (1995).
Brochure, Hot off the Shelf: Application Management, Data Communications (Jan. 1996).
Brochure, "10 Reasons Why You Need an Applications View of Your Network," Compuware Corporation (Jan. 9, 1996).
Brochure, "Network General Corporation: Products and Services", Network General Corporation (1995).
Brochure, "ProView: Network Performance Management Systems", Network Telemetrics, Inc. (1995).
Brochure, "Managing the User Environment across Integrated SNA and IP Networks", Network Telemetrics, Inc. (1995).
Brochure, "Using Performance Baselines to Manage Network Service Levels", Williamson, W., Network Telemetrics, Inc. (1995).
Brochure, "Standard Based Distributed Diagnostics for Enterprise Networks", Frontier Software Development, Inc. (Sep. 1995).
Brochure, "QualityWorks--The most complete client/server testing solution you can buy", Segue Software Products (1996).
Brochure, "LANQuest: Net/WRx", LANQuest (Sep. 12, 1995).
Brochure, "NETBENCH(R) 3.01 Frequently Asked Questions", Ziff-Davis Benchmark Operation.

ART-UNIT: 277

PRIMARY-EXAMINER: Meky; Moustafa M.

ATTY-AGENT-FIRM: Myers Bigel Sibley & Sajovec

ABSTRACT:

Communications network performance is tested utilizing a test scenario determined based on a type of applications traffic expected on the network to be tested. A console node is provided on the network for establishing the test scenario and assigning the test scenario to endpoint nodes on the network to be tested. Each endpoint node is assigned an endpoint node specific test protocol. Execution of the test protocols by the endpoint nodes is initiated by the console node. Performance data such as throughput, transaction rate and response time may be monitored at selected ones of the endpoint nodes and reported to the console node either as it

is generated or after completion of the test. The test scenario may be terminated when all endpoint node specific test protocols have completed execution or when any one endpoint completes execution of its test protocol. Multiple network protocols may be utilized within a single test scenario. Each endpoint node specific test protocol includes an associated script representing a type of applications traffic such as a credit check, or a database update. Endpoint nodes execute tests as applications level programs on existing endpoint nodes on the network to be tested allowing testing of networks using actual protocol stacks independent of the applications programs available on existing endpoint nodes.

14 Claims, 12 Drawing figures

☐ 6. Document ID: US 5937165 A

L4: Entry 6 of 8 File: USPT Aug 10, 1999

US-PAT-NO: 5937165
DOCUMENT-IDENTIFIER: US 5937165 A
**** See image for Certificate of Correction ****

TITLE: Systems, methods and computer program products for applications traffic based communications network performance testing

DATE-ISSUED: August 10, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Schwaller; Peter James	Raleigh	NC		
Walker, II; John Quillian	Raleigh	NC		
Joyce; Steven Thomas	Raleigh	NC		
Huntley; Timothy Scott	Raleigh	NC		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Ganymede Software, Inc	Research Triangle Park	NC			02

APPL-NO: 08/ 711248 [PALM]
DATE FILED: September 10, 1996

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATIONS This application is related to the following applications filed concurrently herewith: METHODS, SYSTEMS AND COMPUTER PROGRAM PRODUCTS FOR TEST SCENARIO BASED COMMUNICATIONS NETWORK PERFORMANCE TESTING, Ser. No. 08/711,195 (pending); and, METHODS, SYSTEMS AND COMPUTER PROGRAM PRODUCTS FOR ENDPOINT PAIR BASED COMMUNICATIONS NETWORK PERFORMANCE TESTING, Ser. No. 08/711,607 now U.S. Pat. No. 5,838,919.

INT-CL: [06] G06 F 13/00

US-CL-ISSUED: 395/200.54
US-CL-CURRENT: 709/224

FIELD-OF-SEARCH: 395/200.54, 395/200.65, 395/200.76, 395/200.81, 395/187.01, 395/200.53, 395/200.6, 370/231, 370/232, 370/235

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4545011	October 1985	Lyon et al.	395/183.19
5049873	September 1991	Robins et al.	340/825.06
5107450	April 1992	Lawrenz	395/200.54
5257393	October 1993	Miller	395/200.54
5572640	November 1996	Schettler	345/440
5634009	May 1997	Iddon et al.	395/200.53
5706436	January 1998	Lewis et al.	395/200.65
5732213	March 1998	Gessel et al.	395/200.54
5764915	June 1998	Heimsoth et al.	395/200.57
5809286	September 1998	McLain, Jr. et al.	395/500

OTHER PUBLICATIONS

Brochure, "The DA-30.RTM. family of internetwork analyzers", Wandel & Goltermann (1994).
Brochure, "DA-30C Benchmarking Capabilities", Wandel & Goltermann (1995).
Brochure, "Vital Signs VisionNet", BlueLine Software, Inc., including inserts "LAN Agent", "VTAM Agent", "NCPL Agent" (1995).
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Brochure, "EcoNET: The View From the Top", Hurwitz Consulting Group, Inc. (1995).
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Brochure, "Network General Corporation: Products and Services", Network General Corporation (1995).
Brochure, "ProView: Nework Performance Management Systems", Network Telemetrics, Inc. (1995).
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Brochure, "Using Performance Baselines to Manage Network Service Levels", Williamson, W., Network Telemetrics, Inc. (1995).
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Brochure, "QualityWorks--The most complete client/server testing solution you can buy", Seghue Software Products (1996).
Brochure, "LANQuest: Net/WRx", LANQuest (Sep. 12, 1995).
Brochure, "Netbench(R) 3.01 Frequently Asked Questions", Ziff-Davis Benchmark Operation.
Butterfield, "System Performance Monitor/2 Reference," International Business Machines Corporation (1991).

ART-UNIT: 277

PRIMARY-EXAMINER: Meky; Moustafa M.

ATTY-AGENT-FIRM: Myers Bigel Sibley & Sajovec

ABSTRACT:

Communications network performance is tested utilizing a test scenario determined based on a type of applications traffic expected on the network to be tested. A console node is provided on the network for establishing the test scenario and assigning the test scenario to endpoint nodes on the network to be tested. Each endpoint node is assigned an endpoint node specific test protocol. Execution of the test protocols by the endpoint nodes is initiated by the console node. Performance data such as throughput, transaction rate and response time may be monitored at selected ones of the endpoint nodes and reported to the console node either as it is generated or after completion of the test. The test scenario may be terminated when all endpoint node specific test protocols have completed execution or when any one endpoint completes execution of its test protocol. Multiple network protocols may be utilized within a single test scenario. Each endpoint node specific test protocol includes an associated script representing a type of applications traffic such as a credit check, or a database update. Endpoint nodes execute tests as applications level programs on existing endpoint nodes on the network to be tested allowing testing of networks using actual protocol stacks independent of the applications programs available on existing endpoint nodes.

70 Claims, 12 Drawing figures

☐ 7. Document ID: US 5881237 A

L4: Entry 7 of 8 File: USPT Mar 9, 1999

US-PAT-NO: 5881237
DOCUMENT-IDENTIFIER: US 5881237 A

TITLE: Methods, systems and computer program products for test scenario based communications network performance testing

DATE-ISSUED: March 9, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Schwaller; Peter James	Raleigh	NC		
Walker, II; John Quillian	Raleigh	NC		
Joyce; Steven Thomas	Raleigh	NC		
Huntley; Timothy Scott	Raleigh	NC		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
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U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
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5049873	September 1991	Robins et al.	
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ART-UNIT: 277

PRIMARY-EXAMINER: Ramirez; Ellis B.

ATTY-AGENT-FIRM: Myers Bigel Sibley & Sajovec

ABSTRACT:

Communications network performance is tested utilizing a test scenario simulating actual communications traffic on the network to be tested. A console node is provided on the network for establishing the test scenario and assigning the test scenario to endpoint nodes on the network to be tested. Each endpoint node is assigned an endpoint node specific test protocol. Execution of the test protocols by the endpoint nodes is initiated by the console node. Performance data such as throughput, transaction rate and response time may be monitored at selected ones of the endpoint nodes and reported to the console node either as it is generated or after completion of the test. The test scenario may be terminated when all endpoint node specific test protocols have completed execution or when any one endpoint completes execution of its test protocol. Multiple network protocols may be utilized within a single test scenario. Each endpoint node specific test protocol includes an associated script representing a type of applications traffic such as a credit check, or a database update. Endpoint nodes execute tests as applications level programs on existing endpoint nodes on the network to be tested allowing testing of networks using actual protocol stacks independent of the applications programs available on existing endpoint nodes.

41 Claims, 12 Drawing figures

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INVENTOR-INFORMATION:

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U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
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Brochure, "EcoNet.sup..TM. : Networked Applications Performance Management", Compuware Corporation (1995).
Brochure, "Hot off the Shelf: Application Management", Data Communications (Jan. 1996).
Brochure, "EcoNet: The View From the Top", Hurwitz Consulting Group, Inc. (1995).
Brochure, "10 Reasons Why You Need An Applications View of Your Network", Compuware Corporation (Jan. 9, 1996).
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Brochure, "Managing the User Environment across Integrated SNA and IP Networks", Network Telemetrics, Inc. (1995).
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Brochure, "NETBENCH(R) 3.01 Frequently Asked Questions", Ziff-Davis Benchmark Operation.

ART-UNIT: 274

PRIMARY-EXAMINER: Trammell; James P.

ASSISTANT-EXAMINER: Peeso; Thomas

ATTY-AGENT-FIRM: Myers Bigel Sibley & Sajovec, P.A.

ABSTRACT:

Communications network performance is tested utilizing a test scenario simulating actual communications traffic on the network to be tested. The test scenario includes an endpoint node specific test protocol between an endpoint node pair including a first and associated second endpoint node on the network to be tested. A partner endpoint node test protocol is determined from the endpoint node specific test protocol and communicated to from the first endpoint node to the associated second endpoint node of the endpoint node pair. A plurality of endpoint node pairs may executed different endpoint node specific test protocols under a test scenario. A console node is provided on the network for establishing the test scenario and assigning the test scenario to endpoint node pairs and initiating execution of the test scenario. Performance data may be monitored at one of the endpoint nodes of each endpoint node pair and reported to the console node either as it is generated or after completion of the test.

34 Claims, 12 Drawing figures

Term	Documents
STATISTIC	5235
STATISTICS	24869
CALCULAT$	0
CALCULAT	28
CALCULATABILITY	2
CALCULATABLE	389
CALCULATABLY	6
CALCULATAD	6
CALCULATAED	6
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TITLE: Methods, systems and computer program products for endpoint pair based communications network performance testing

Brief Summary Text (4):
Computer networks have grown increasingly complex with the use of distributed client/server applications, mixed platforms and multiple protocols all on a single physical backbone. The control of traffic on the networks is likewise moving from centralized information systems departments to distributed workgroups. The growing utilization of computer networks is not only causing a move to new, high-speed technologies but is at the same time making the operation of computer networks more critical to day-to-day business operations.

Brief Summary Text (5):
The growth in complexity and dependence on computer networks heightens the need for network management tools to design, build and maintain computer networks. The mix of protocols and vendors of installed hardware on many computer networks generally increases the difficulty of accomplishing network management. This problem may arise in planning or designing changes to a network, monitoring performance of a network, and testing the impact on performance of different hardware and software being installed on a network. A variety of approaches to network management tools have been considered including, frame generators, passive monitors, simulation tools, and applications testers. However, each of these categories of network management tools may have its own limitations affecting a users ability to manage increasingly complex and critical computer networks.

Brief Summary Text (8):
Another network management tool is a simulation tool. Simulation tools provide a mathematical model of a network. The model is generated based on information about network design, hardware, and traffic patterns. Once the model is created, it can be used to predict network performance under different scenarios. However, these tools are generally limited in their ability to accurately model the network and update the model as the network is changed. In addition, various network problems can arise from subtle differences in configuration, queuing, congestion control and frame sizes which are typically difficult to model. Furthermore, they typically only simulate network performance for when a network is working correctly rather than identifying problems.

Brief Summary Text (10):
Various other testers aimed at addressing particular aspects of network management are available. ProView-SNA utilizes active traffic generation to measure network performance characteristics by monitoring round trip response times to SNA hosts and to LAN file servers. Under control of a ProView Management Station, Remote Agents execute application layer transactions, compute round trip response time and forward the results to the Management Station for display and storage. Net sench is a Ziff-Davis benchmark program that measures the performance of servers in a file server environment. It provides a way to measure, analyze, and predict how a server handles network file I/O requests from client computers in a file server environment.

Brief Summary Text (19):
Individual ones of the endpoint nodes of each pair generate communications traffic to the other endpoint node of the pair. Endpoint nodes executing the test scenario may be existing endpoints on the network such as user terminals or file servers and an endpoint node of each pair may measure performance of the network during execution of its respective test protocol. Different endpoint node pairs can be operated with different network protocols and different scripts during execution of the overall test scenario on the network, thereby allowing a varied mix of communications traffic representative of actual network operating conditions. Furthermore, because all of the individual endpoint protocols are associated under the defined test scenario, the test conditions, while flexible enough to represent actual operating conditions, are repeatable thereby allowing testing of changes in network hardware or software under controlled conditions which nonetheless reflect actual operating conditions. Test scenarios may also be varied to stress test different components of the network environment.

Brief Summary Text (22):
Accordingly, the present invention provides for testing performance of a communications network including a plurality of endpoint nodes under conditions reflecting the actual operating conditions of the network to be tested. A test scenario is defined including an endpoint node specific test protocol between a first endpoint node and an associated second endpoint node to simulate communications traffic therebetween to be tested. A partner endpoint node test protocol is determined from the endpoint node specific test protocol. The partner endpoint node test protocol is communicated over the network from a first endpoint node of an endpoint node pair to the other endpoint node of the pair. The test scenario may also include a network protocol for communications between the nodes of the endpoint node pair thereby providing a mix of network protocols in a single test scenario. Execution of the endpoint node specific test protocols is then initited. Performance of the network is monitored while the endpoint node specific test protocols are executed to obtain performance data. The endpoint node specific test protocols may include a type of data to transmit, how many times to transmit the data, what portion of the test protocol to time during execution, and what acknowledgments to receive during execution of the test protocol.

Detailed Description Text (7):
As will be understood by those having skill in the art, a communications network 12 may be comprised of a plurality of separate linked physical communication networks which, using a protocol such as the Internet protocol, may appear to be a single seamless communications network to user application programs. For example, as illustrated in FIG. 1, remote network 12' and communications network 12 may both include a communication node at endpoint node 18. Accordingly, additional endpoint nodes (not shown) on remote network 12' may be made available for communications from endpoint nodes 14, 15, 16, 17. It is further to be understood that, while for illustration purposes in FIG. 1, communications network 12 is shown as a single network it may be comprised of a plurality of separate interconnected physical networks. As illustrated in FIG. 1, endpoint nodes 14, 15, 16, 17, 18 may reside on a computer. As illustrated by endpoint node 18, a single computer may comprise multiple endpoint nodes. Performance testing of the present invention as illustrated in FIG. 1 further includes a designated console node 20. The present invention tests the performance of communications network 12 by the controlled execution of application type communication traffic between the various endpoint nodes 14, 15, 16, 17, 18 on communications network 12.

Detailed Description Text (13):
In practicing the present invention, network performance test results are based upon timing measurements. Accordingly, as each endpoint node pair 22, 24 reaches predetermined checkpoints within a script, it creates timing records. The timing records are returned to console node 20 which uses them to analyze the performance

of communications network 12 by calculating statistics about a test run. Console node 20 also provides means for both initiating and terminating a test.

Detailed Description Text (22):
Within each script, a variety of commands are utilized in emulating applications traffic. There are two categories of script commands: communication commands (such as SEND and RECEIVE) and program control commands (such as LOOP). TABLE 3 lists examples of communication commands which can be beneficially used in scripts according to the present invention. Also listed in TABLE 3 is a mapping of these commands to APPC and sockets APIs.

Detailed Description Text (23):
Shown in TABLE 4 are program control commands which may be beneficially applied to scripts in practicing the present invention to control their operation.

Detailed Description Text (31):
This is a version of a Database Update transaction that uses a long connection. This is a complex standard benchmark. It simulates a program that requests a record from Endpoint 2 node 16, 17, gets it, updates it and sends it back. Lastly, Endpoint 1 node 14, 15 receives a confirmation that the update was completed. (This script-can be described as an Inquiry followed by a Credit Check.)

Detailed Description Text (33):
This is a version of a Database Update transaction that uses short connections. This is a complex standard benchmark. It simulates a program that requests a record from Endpoint 2 node 16, 17, gets it, updates it and sends it back. Lastly, Endpoint 1 node 14, 15 receives a confirmation that the update was completed. (This script can be described as an Inquiry followed by a Credit Check.)

Detailed Description Text (35):
This is a version of a File Receive transaction that uses a long connection. This transaction simulates requesting a file and getting it back.

Detailed Description Text (37):
This is a version of a File Receive transaction that uses short connections. This transaction simulates requesting a file and getting it back.

Detailed Description Text (43):
This is a version of an Inquiry transaction that uses a long connection. This is a standard client/server transaction. Endpoint 1 node 14, 15 sends a request to Endpoint 2 node 16, 17, which sends a reply back. The script variables let you add delays, and change the send and receive buffer sizes.

Detailed Description Text (45):
This is a version of an Inquiry transaction that uses short connections. This is a standard client/server transaction. Endpoint 1 node 14, 15 sends a request to Endpoint 2 node 16, 17, which sends a reply back. The script variables. let you add delays, and change the send and receive buffer sizes.

Detailed Description Text (47):
This is a Packet Transmit (Long Send) transaction, which uses a long connection. This long-running transaction continuously sends packets from Endpoint 1 node 14, 15 to Endpoint 2 node 16, 17. This may not be a good transaction for benchmarking because it does not acknowledge that data has been received. Measurements can be inaccurate, because the script ends without waiting for the receiving side to catch up. This test uses the FLUSH script command. While it has no effect on TCP/IP, it causes APPC to send data immediately, rather than waiting to fill buffers. This script is suitable for generating background traffic. Depending upon the network protocol chosen, this script allows some control over the packet size used at the Data Link Control layer.

Detailed Description Text (49):
Referring now to FIG. 3, an embodiment of a console node 20 of the present invention is illustrated. Console node 20 resides on a computer including an interface to at least one communications network 12, 12'. Console node 20 includes console program 26 or other means for executing console operations. Console program 26 preferably is implemented as a console software program executing on the computer of console node 20, but it is to be understood that console program 26 may be implemented in whole or in part with hardware. Console program 26 sets up and controls test runs. Console program 26 communicates with endpoint nodes 14, 15, 16, 17, 18, sending them scripts to run and gathering the results of their runs. Console program 26 allows a user to build scenarios from selected scripts, change the values of the variables associated with a given script and display and print scripts to see what will take place among endpoints 14, 15, 16, 17, 18. Console program 26 can read from and write to files and logs on the computer on which console node 20 resides. Scenario scripts and the results of runs may be saved by console program 26 for review by a user.

Detailed Description Text (55):
Console engine 30 also provides functions for file input/output and printing. Console graphic user interface 28 issues calls that request a file to be opened or saved to which console engine 30 responds by handling the actual file operations.

Detailed Description Text (58):
Stack interface module 34, 34' is provided so that calls by console engine 30 may be made without knowing the specific details of the network protocol stack being used. This allows console engine 30 to use a generic set of functions to perform communications including the following: connect_initiate, connect_accept, send, receive, flush, confirm_request, confirm_acknowledge and disconnect. Stack interface 34, 34' ports these generic functions to specific network protocols such as APPC, TCP/IP or other network protocols. The network interface protocol apparatus, or other network interface means for connecting console node 20 to network 12 for communications over network 12, is illustrated in FIG. 3 as network interface 36. Network interface 36 provides console node 20 means for communicating with endpoint nodes 14, 15, 16, 17, 18 over network 12 for communicating endpoint information including test protocols, for initiating execution of test protocols in a test scenario and for receiving reported monitored performance data from endpoint nodes 14, 15, 16, 17, 18 and for terminating execution of a test scenario on network 12.

Detailed Description Text (62):
Endpoint program 40 includes endpoint master 44. Endpoint master 44, or other endpoint master means, acts as a manager for starting up additional threads of execution or endpoint engines 46, 46' when console node 14 initiates a scenario. Endpoint master 44 accepts incoming connections from console node 20 via any supported protocol such as APPC or TCP/IP. Endpoint master 44 also accepts stop requests from console node 20 and advises endpoint engine 46, 46' that console node 20 has requested a stop. Endpoint master 44 is preferably prestarted before execution of any task to reduce the protocol configuration that is required at the endpoint.

Detailed Description Text (85):
At Block 90 all of the designated nodes are configured. In practicing an embodiment of the present invention, console program 26 and endpoint program 40 operate as application-level programs much like commercially available programs such as Lotus Notes and FTP. Accordingly, they interact over communications network 12 with network protocols such as APPC and TCP interfaces-for their network communications. The operations at Block 90 insure proper communications between console program 26 and endpoint program 40 on communications network 12 using a network protocol. The operations at Block 90 include determining the network addresses of endpoint nodes

14, 15, 16, 17, 18 and control node 20, selecting service quality for tests where available from the network protocol and, preferably, testing the network connections.

Detailed Description Text (86):
An example of the operations at Block 90 in an APPC environment will now be briefly described. Additional information describing the setup of APPC across a variety of platforms is provided in the Multi-Platform Configuration Guide (MPCONFIG) and is available from IBM. In an APPC network environment, a fully qualified LU name is the easiest network address to use when practicing the present invention. It is constructed by concatenating the network name, a period, and a control point (CP) or LU name. Although multiple LUs may be defined at a single computer, one always serves the role of the control point LU.

Detailed Description Text (112):
The operations of the present invention have been generally described in connection with the Figures for tests where no errors are encountered. Error handling is preferably coordinated by console node 20 which is the point where user information is provided. There are many operations initiated by user input, such as running a scenario. The operation is handed to console engine 30 to complete, which notifies console graphic user interface 28 of the operation's success or failure at a later time. If a failure of any type occurs, the console engine 30 signals console graphic user interface 28 of the error, returning the failure return code and the handle to the basic message text associated with that return code. The console engine 30 also returns the handle of the appropriate object, so console graphic user interface 28 can obtain additional information. For example, if endpoint pair 22,24 could not be started, the console engine 30 returns the handle of the endpoint pair 22,24 that failed, along with the return code and its handle. Console graphic user interface 28 displays and logs the error; if the user requests additional help text for the error, console graphic user interface 28 requests the advanced message text from console engine 30. Console graphic user interface 28 then displays the advanced text.

Detailed Description Text (122):
Send(request to start)

Detailed Description Paragraph Table (3):
TABLE 2 EXAMPLE TEST SCRIPTS Script Name File Name Description Credit Check CREDITL.SCR This is a quick transaction that CREDITS.SCR simulates a series of credit approvals. A record is sent from Endpoint 1. End- point 2 receives the record and sends back a confirmation. The default record size is 100 bytes. Database DBASEL.SCR This is the most complex of the Update DBASES.SCR standard benchmarks. This script simulates a program that requests a record from Endpoint 2, gets it, updates it and sends it back. Lastly, Endpoint 1 receives a confirmation that the update was completed. The default sizes for the request and the record are 100 bytes. (This script can be described as an Inquiry followed by a Credit Check.) File Transfer FILERCVL.SCR This transaction simulates requesting a (Receive) FILERCVS.SCR file and getting it back. The request from Endpoint 1 defaults to 100 bytes. The default file size is 100,000 bytes. File Transfer FILESNDL.SCR This transaction simulates sending a file (Send) FILESNDS.SCR from Endpoint 1 to Endpoint 2, and getting a confirmation back. The default file size is 100,000 bytes. Inquiry INQUIRYL.SCR This is a standard client/server trans- INQUIRYS.SCR action. Endpoint 1 sends a request to Endpoint 2, which sends a reply back. Both the request and reply default to 100 bytes. The script variables let you add delays, and change the send and receive buffer sizes. Packet PACKETL.SCR This script sends individual packets, as Transmit quickly as possible, without waiting for (Long Send) any kind of response. This is not a good test for gathering performance informa- tion. Measurements can be inaccurate, because the script ends without waiting for the receiving side to catch up. This test uses the FLUSH script command. While it has no effect on TCP/IP, it causes APPC to send data immediately;

rather than waiting to fill buffers.

Detailed Description Paragraph Table (4):
TABLE 3 COMMUNICATIONS COMMANDS Command APPC TCP Sockets CONNECT_INITIATE TP_STARTED socket( ) ALLOCATE bind( ) connect( ) CONNECT_ACCEPT RECEIVE_ALLOCATE socket( ) bind( ) listen( ) accept( ) SEND (byte_count, buffer_size) Using SEND_DATA, send the Using write( ), send the number of number of bytes in byte_count, in bytes in byte_count, in buffer_size buffer_size chunks. The last buffer chunks. The last buffer may be sent may be smaller than the smaller than the buffer_size. The buffer_size. The maximum maximum allowable value is 32767. allowable value is 32767. RECEIVE (byte_count, buffer_size) Issue RECEIVE_AND_WAIT calls Issue read( ) calls in a loop, until the in a loop, until the number of bytes number of bytes specified in specified in byte_count have been byte_count have been received, in received, in buffer_size chunks. buffer_size chunks. The last buffer The last buffer received may be received may be smaller than the smaller than the buffer_size value. buffer_size value. The maximum The maximum value is also 32767. allowable value is 32767. CONFIRM_REQUEST CONFIRM Receive special data record from partner. CONFIRM_ACKNOWLEDGE CONFIRMED Send special data record to partner. DISCONNECT Issue DEALLOCATE on the close( ) sending side; do memory cleanup on the receiving side. FLUSH FLUSH none (TCP/IP automatically sends data without waiting to fill network buffers)

Detailed Description Paragraph Table (5):
TABLE 4 PROGRAM_CONTROL COMMANDS Command Description LOOP (n) Repeat this loop "n" times. "n" is an integer in the range 1 to 999,999,999. END LOOP This marks the end of a loop. START_TIMER Marks the beginning of a checkpoint, and resets the transaction count to 1. Because timing records are kept only at Endpoint 1, this command is only used in the Endpoint 1 portion of scripts. END_TIMER Marks the end of a checkpoint. Causes a timing record to be built, which includes the transaction count. Because timing records are kept only at Endpoint 1, this command is only used in the Endpoint 1 portion of scripts. INCREMENT_TRANSACTIONS This increments the number of transactions per timing record. If transactions are being counted, count another transaction. This value is reset to 1 each time a START_TIMER command is executed. Because timing records are kept only at Endpoint 1, this command is only used in the End- point 1 portion of scripts. SLEEP (n) Don't do anything for "n" milli- seconds. "n" is an integer in the range 0 to 999,999,999. The default value is 0, which means not to wait. Sleep commands can be used to simulate application processing time or human delays between trans- actions.

Detailed Description Paragraph Table (6):
Endpoint 1 Endpoint 2 CONNECT_INITIATE CONNECT_ACCEPT LOOP LOOP number_of_timing_records=50 number_of_timing_records=50 START_TIMER LOOP LOOP transactions_per_record=50 transactions_per_record=50 RECEIVE SEND size_of_record_to_send=100 size_of_record_to_send=100 receive_buffer_size=DEFAULT send_buffer_size=DEFAULT SLEEP CONFIRM_REQUEST delay_before_responding=0 INCREMENT_TRANSACTION CONFIRM_ACKNOWLEDGE END_LOOP END_LOOP END_TIMER END_LOOP SLEEP DISCONNECT transaction_delay=0 END_LOOP DISCONNECT Variable Name Default Description number_of_timing_records 50 How many timing records to generate transactions_per_record 50 Transactions per timing record size_of_record_to_send 100 Amount of data to be sent send_buffer_size DEFAULT How many bytes of data in each SEND receive_buffer_size DEFAULT How many bytes of data in each RECEIVE transaction_delay 0 Milliseconds to pause delay_before_responding 0 Milliseconds to wait before responding

Detailed Description Paragraph Table (7):
Endpoint 1 Endpoint 2 LOOP LOOP number_of_timing_records=50 number_of_timing_records=50 START_TIMER LOOP LOOP transactions_per_record=25 transactions_per_record=25 CONNECT_ACCEPT CONNECT_INITIATE RECEIVE SEND size_of_record_to_send=100 size_of_record_to_send=100 receive_buffer_size=DEFAULT send_buffer_size=DEFAULT SLEEP CONFIRM_REQUEST delay_before_responding=0 DISCONNECT

CONFIRM_ACKNOWLEDGE INCREMENT_TRANSACTION DISCONNECT END_LOOP END_LOOP END_TIMER END_LOOP SLEEP transaction_delay=0 END_LOOP Variable Name Default Description number_of_timing_records 50 How many timing records to generate transactions_per_record 25 Transactions per timing record size_of_record_to_send 100 How many bytes of data in each SEND send_buffer_size DEFAULT How many bytes of data in each SEND receive_buffer_size DEFAULT How many bytes of data in each RECEIVE transaction_delay 0 Milliseconds to pause delay_before_responding 0 Milliseconds to wait before responding

Detailed Description Paragraph Table (8):
Endpoint 1 Endpoint 2 CONNECT_INITIATE CONNECT_ACCEPT LOOP LOOP number_of_timing_records=50 number_of_timing_records=50 START_TIMER LOOP LOOP transactions_per_record=25 transactions_per_record=25 RECEIVE SEND size_of_record_to_send=100 size_of_record_to_send=100 size_of_record_to_send=100 size_of_record_to_send=100 SEND RECEIVE reply_size=100 reply_size=100 reply_size=100 reply_size=100 RECEIVE SEND update_size=100 update_size=100 update_size=100 update_size=100 CONFIRM_ACKNOWLEDGE CONFIRM_REQUEST END_LOOP INCREMENT_TRANSACTION END_LOOP END_LOOP DISCONNECT END_TIMER SLEEP transaction_delay=0 END_LOOP DISCONNECT Variable Name Default Description number_of_timing_records 50 How many timing records to generate transactions_per_record 25 Transactions per timing record size_of_record_to_send 100 Amount of data to be sent reply_size 100 How many bytes to send in the reply update_size 100 How many bytes to send in the update transaction_delay 0 Milliseconds to pause

Detailed Description Paragraph Table (9):
Endpoint 1 Endpoint 2 LOOP LOOP number_of_timing_records=50 number_of_timing_records=50 START_TIMER LOOP LOOP transactions_per_record=10 transactions_per_record=10 CONNECT_ACCEPT CONNECT_INITIATE RECEIVE SEND size_of_record_to_send=100 size_of_record_to_send=100 size_of_record_to_send=100 size_of_record_to_send=100 SEND RECEIVE reply_size=100 reply_size=100 reply_size=100 reply_size=100 RECEIVE SEND update_size=100 update_size=100 update_size=100 update_size=100 CONFIRM_ACKNOWLEDGE CONFIRM_REQUEST DISCONNECT DISCONNECT END_LOOP INCREMENT_TRANSACTION END_LOOP END_LOOP END_TIMER SLEEP transaction_delay=0 END_LOOP Variable Name Default Description number_of_timing_records 50 How many timing records to generate transactions_per_record 10 Transactions per timing record size_of_record_to_send 100 Amount of data to be sent reply_size 100 How many bytes to send in the reply update_size 100 How many bytes to send in the update transaction_delay 0 Milliseconds to pause

Detailed Description Paragraph Table (12):
Endpoint 1 Endpoint 2 CONNECT_INITIATE CONNECT_ACCEPT LOOP LOOP number_of_timing_records=100 number_of_timing_records=100 START_TIMER LOOP LOOP transactions_per_record=1 transactions_per_record=1 RECEIVE SEND file_size=100000 file_size=100000 receive_buffer_size=DEFAULT send_buffer_size=DEFAULT CONFIRM_ACKNOWLEDGE CONFIRM_REQUEST END_LOOP INCREMENT_TRANSACTION END_LOOP END_LOOP DISCONNECT END_TIMER SLEEP transaction_delay=0 END_LOOP DISCONNECT Variable Name Default Description number_of_timing_records 100 How many timing records to generate transactions_per_record 1 Transactions per timing record file_size 100,000 How many bytes are in the file send_buffer_size DEFAULT How many bytes of data in each SEND receive_buffer_size DEFAULT How many bytes of data in each RECEIVE transaction_delay 0 Milliseconds to pause

Detailed Description Paragraph Table (13):
Endpoint 1 Endpoint 2 LOOP LOOP number_of_timing_records=100 number_of_timing_records=100 START_TIMER LOOP LOOP transactions_per_record=1 transactions_per_record=1 CONNECT_ACCEPT CONNECT_INITIATE RECEIVE SEND file_size=100000 file_size=100000 receive_buffer_size=DEFAULT send_buffer_size=DEFAULT CONFIRM_ACKNOWLEDGE CONFIRM_REQUEST DISCONNECT DISCONNECT

END_LOOP INCREMENT_TRANSACTION END_LOOP END_LOOP END_TIMER SLEEP transaction_delay=0 END_LOOP Variable Name Default Description number_of_timing_records 100 How many timing records to generate transactions_per_record 1 Transactions per timing record file_size 100,000 How many bytes are in the file send_buffer_size DEFAULT How many bytes of data in each SEND receive_buffer_size DEFAULT How many bytes of data in each RECEIVE transaction_delay 0 Milliseconds to pause

CLAIMS:

9. A communications network performance testing system according to claim 8 wherein said network is a computer network including a console node residing on a computer and wherein said first one of said plurality of endpoint nodes and said associated second one of said plurality of endpoint nodes reside on computers and wherein said means for providing includes means for providing said endpoint node specific test protocol to said first one of said plurality of endpoint nodes from said console node over said network and wherein said network performance testing system further comprises means operatively connected to said network for monitoring performance of said network while said endpoint node specific test protocol is executed to obtain performance data.

14. A communications network performance testing system for testing a communications network including a plurality of endpoint nodes, said testing system comprising:

means for defining an endpoint node pair based test scenario including an endpoint node specific test protocol between each of a plurality of endpoint node pairs selected from said plurality of endpoint nodes to simulate communications traffic between each of said endpoint node pairs to be tested;

means for providing a presetup flow including a requirements list to each of said endpoint node pairs;

means operatively connected to said means for defining and to said network for providing said endpoint node specific test protocol to each of said endpoint node pairs over said network;

means operatively connected to said network for executing said test scenario; and

means operatively connected to said network for monitoring performance of said network during execution of said test scenario.

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